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(72) Inventor PANAYOTIS GEORGE TYROPOLIS



## (54) NON-WOVEN FABRICS

(71) We, BONDED FIBRE FABRIC LIMITED, a British Company, of Bath Road, Bridgwater, Somerset, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to non-woven fabrics and in particular to heat-sealable flushable non-woven fabrics, suitable, for example, for use as the outer wrapping for absorbent cores in the manufacture of sanitary napkins, diapers and similar articles, hereinafter referred to as napkins.

A flushable non-woven fabric is a fabric which when subjected to water turbulence in a domestic water-closet bowl will disintegrate into pieces capable of being flushed away into a septic sewerage system without risk of blockage of the system. When used as the outer wrapping for a napkin in which the absorbent core is of a material which itself will rapidly disintegrate, the napkin, after use, may conveniently be disposed of in a water closet thus avoiding the problems which hitherto have been met in the disposal of used conventional napkins. It is, however, important that the flushable non-woven fabric retains its strength as an outer wrapper for the napkin when in use but readily disintegrates under water closet disposal conditions.

In the manufacture of napkins, it is usual to wrap the outer wrapper around the absorbent core material and seal the ends of the wrapper, for example with an adhesive, to enclose the core. The non-woven fabric of the present invention having the properties of heat-sealability coupled with flushability permits the sealing of the wrapper about the core to be carried out by conventional heat-sealing techniques.

According to the present invention a heat-sealable flushable non-woven fabric comprises a web of natural and/or synthetic fibres impregnated with a heat-sealable

water-disintegratable composition which provides coherency of the web in use, the composition comprising a mixture of a water-soluble metallic salt of an acrylic copolymer together with up to 50% by weight of the composition of a water-insoluble polyacrylate or acrylic copolymer, the amount of the water-insoluble polyacrylate or acrylic copolymer being such as to limit the rate of disintegration in water of the composition.

The heat-sealable water-disintegratable composition preferably comprises between 60% and 80% by weight of the water-soluble salt of an acrylic copolymer and between 20% and 40% by weight of the water-insoluble polyacrylate or acrylic copolymer.

The amount of composition which is applied to the web is sufficient to ensure coherency of the web during normal use, for example as a wrapper for a napkin. This amount may be between 10% and 35% by weight dry solids on the dry fabric, and although other amounts may be used, the amount will not generally exceed about 35% by weight dry solids.

The water-soluble salt may conveniently be a sodium salt of an acrylic copolymer. The water-insoluble polyacrylate or acrylic copolymer in the composition may be a water soluble ammonium salt which after application to the fabric and on drying by the application of heat is converted to an insoluble state.

In a preferred form of the invention the web is impregnated with a discontinuous pattern of the heat-sealable water-dispersible composition in which the composition covers at least 15% of the surface area of the web and, more preferably, between 20% and 50% of the surface area of the web.

The composition may conveniently be applied to the web by printing in the form of closely spaced lines, discontinuous lines, discrete spots, or other discontinuous pattern.

In order to assist the passage of the web

through the impregnation step it is preferred to pre-bond the fibres prior to impregnation with the composition by treatment with between 0.2% and 12%, or more preferably between 0.5% and 5.0%, by weight of a water-soluble bonding agent such as, for example, sodium carboxymethyl cellulose, a water-soluble polyvinyl alcohol or a water-soluble salt of an acrylic copolymer.

The fibres forming the web preferably consist of cotton, rayon or a mixture thereof with or without a minor proportion of synthetic plastics fibres. The fibre length preferably lies in the range between about 1/2 inch and 2 inches and the web has a weight in the range between 10 and 18 grams per square metre.

The invention further includes a method of manufacture of a heat sealable, flushable non-woven fabric comprising impregnating a web of natural and/or synthetic fibres with a heat-sealable water-disintegratable composition which provides coherency of the web in use, the composition comprising a mixture of a water-soluble metallic salt of an acrylic copolymer together with up to 50% by weight of the composition of a water-insoluble polyacrylate or acrylic copolymer or a water-soluble ammonium salt of a polyacrylate or acrylic copolymer, the amount of the water-insoluble polyacrylate or acrylic copolymer or water-soluble ammonium salt of a polyacrylate or acrylic copolymer being such as to limit the rate of disintegration in water of the composition, and drying the composition by the application of heat.

In one embodiment of the present invention the water-soluble metallic salt of the acrylic copolymer in the composition is replaced wholly or partly by a water-soluble metallic salt of a polyacrylate.

The invention also includes a flushable napkin comprising a core of a water-disintegratable absorbent material enclosed in a wrapper of a heat-sealable, flushable non-woven fabric manufactured in accordance with the present invention.

The core of water-disintegratable absorbent material when released from the wrapper must be capable of separating into a form of pieces of a size capable of passage through a conventional sewerage system without risk of blockage. The core may consist of wood fluff, cotton batting, tissue paper and like known materials.

The invention will now be further illustrated by way of a specific example.

#### EXAMPLE

A carded web weighing 12 grams per square metre consisting of rayon fibres of length 1 7/16 inches was impregnated with a pre-bonding agent consisting of a solu-

tion in water of sodium carboxymethyl cellulose to yield after drying a non-woven fabric containing 1.5% by weight of the bonding agent.

The web was then printed on one side with a series of strips, 1 mm. wide and separated by 3 mms. with a composition consisting of an intimate mixture of:—

3 parts by weight dry product of a water-soluble sodium salt of an acrylic copolymer marketed by Allied Colloids Manufacturers Company Limited of Bradford, England as "GLASCOL (Registered Trade Mark) HN4" and:—

1 part by weight dry product of a water-insoluble self-cross linking anionic ethyl acrylate polymer marketed in emulsion form by BP Chemicals International Limited, Penarth, Glamorgan, Wales as "BREON (Registered Trade Mark) 2671", part dissolved and part dispersed in water to the extent of 25% solids by weight in an amount to provide 25% by weight dry composition on the dry web. The fabric was then dried by the application of heat.

The water-insoluble ethyl acrylate polymer had the effect of reducing the rate of water-disintegratability of the composition which otherwise would occur in the presence alone of the water-soluble sodium salt of the acrylic copolymer.

The water dispersibility of the fabric so produced was tested as follows:—

A piece of the fabric 22 cms. square was fitted into a circular embroidery frame 16.5 cms. in diameter and a metal disc 9.3 cms. in diameter and weighing 100 grams was placed centrally on top of the fabric. The assembly was totally immersed in water at ambient temperature when it was found that the fabric disintegrated and allowed the disc to fall through the frame in 15 seconds.

A sanitary napkin was produced by overwrapping an elongated core of wood fluff in a length of the on-woven fabric which overlapped the ends of the core. The overlapping ends were flattened and secured by heat-sealing between a pair of heat-seal jaws.

The napkin was subjected to a flushing operation in a domestic water-closet where it was found that in the water turbulence the wrapper rapidly disintegrated releasing the absorbent core which broke up and passed into the sewerage system.

#### WHAT WE CLAIM IS:—

1. A heat-sealable flushable non-woven fabric comprising a web of natural and/or synthetic fibres impregnated with a heat-sealable water-disintegratable composition which provides coherency of the web in use, the composition comprising a mixture of a water-soluble metallic salt of an acrylic copolymer together with up to 50% by

weight of the composition of a water-insoluble polyacrylate or acrylic copolymer, the amount of the water-insoluble polyacrylate or acrylic copolymer being such as to limit the rate of disintegration in water of the composition.

2. A fabric as claimed in claim 1 in which the heat-sealable water-disintegratable composition comprises a mixture of between 60% and 80% by weight of the water-soluble metallic salt of an acrylic copolymer and between 20% and 40% by weight of the water-insoluble polyacrylate or acrylic copolymer.

3. A fabric as claimed in claim 1 or claim 2 in which the water-soluble metallic salt is a sodium salt of an acrylic copolymer.

4. A fabric as claimed in claim 1, claim 2 or claim 3 in which the web is impregnated with the composition in an amount between 10% and 35% by weight dry solids on dry fabric.

5. A fabric as claimed in any one of the preceding claims 1 to 4 in which the web is impregnated with a discontinuous pattern of the composition in which the composition covers at least 15% of the surface area of the web.

6. A fabric as claimed in claim 5 in which the composition covers between 20% and 50% of the surface area of the web.

7. A fabric as claimed in claim 5 or claim 6 in which the composition is applied to the web by printing in the form of closely spaced lines, discontinuous lines or discrete spots.

8. A fabric as claimed in any one of the preceding claims 1 to 7 in which the fibres of the web prior to the impregnation step are pre-bonded by treatment with between 0.2% and 12.0% by weight of a water-soluble bonding agent.

9. A fabric as claimed in claim 8 in which the fibres of the web are pre-bonded by treatment with between 0.5 and 5.0% by weight of the water-soluble bonding agent.

10. A fabric as claimed in any one of the preceding claims 1 to 9 in which the fibres forming the web consist of cotton, rayon or a mixture thereof with or without a minor proportion of synthetic plastics fibres.

11. A fabric as claimed in claim 10 in which the fibre length of the fibres lies in the range between  $\frac{1}{2}$  inch and 2 inches

and the web has a weight in the range between 10 and 18 grams per square metre.

12. A fabric as claimed in claim 1 substantially as specifically described in the Example.

13. A fabric as claimed in any one of the claims 1 to 12 with the modification that the water-soluble metallic salt of the acrylic copolymer is replaced wholly or partly by a water-soluble metallic salt of a polyacrylate.

14. A method of manufacture of a heat-sealable flushable non-woven fabric comprising impregnating a web of natural and/or synthetic fibres with a heat-sealable water-disintegratable composition which provides coherency of the web in use, the composition comprising a mixture of a water-soluble metallic salt of an acrylic copolymer together with up to 50% by weight of the composition of a water-insoluble polyacrylate or acrylic copolymer or a water-soluble ammonium salt of a polyacrylate or acrylic copolymer, the amount of the water-insoluble polyacrylate or acrylic copolymer or water-soluble ammonium salt of a polyacrylate or acrylic copolymer being such as to limit the rate of disintegration in water of the composition, and drying the composition by the application of heat.

15. A method of manufacture as claimed in claim 14 with the modification that the water-soluble metallic salt of the acrylic copolymer is replaced wholly or partly by a water-soluble metallic salt of a polyacrylate.

16. A fabric when manufactured by the method as claimed in claim 14.

17. A fabric when manufactured by the method as claimed in claim 15.

18. A flushable napkin comprising a core of a water-disintegratable absorbent material enclosed in a wrapper of a heat-sealable flushable fabric as claimed in any one of the claims 1 to 12 and 16.

19. A flushable napkin comprising a core of a water-disintegratable absorbent material enclosed in a wrapper of a heat-sealable flushable fabric as claimed in claim 13 or claim 17.

BOULT, WADE & TENNANT,  
Chartered Patent Agents,  
34 Cursitor Street,  
London, EC4A 1PQ.